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Data Article

Dataset of source-sink manipulation through growth retardant for enhancing productivity and profitability of cotton in north west, India

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A B S T R A C T

Two different field experiments were conducted at Punjab Agricultural University, Regional Research Station, Bathinda, (1) to manage optimum source-sink relationship through mepiquat chloride (MC) in *Bt* cotton hybrid and (2) to find feasibility of MC application on non hybrid compact cotton genotype under high density planting system (HDPS) with varied nitrogen levels. Raw data for growth and yield parameters was recorded from each treatment and statistically analysed. In experiment (1), application of MC 75 g active ingredient per hectare (a.i./ha) irrespective of splits between 60 and 90 days after sowing (DAS) was effective for significant reduction in plant height, increase in bolls per plant as compared to control and de-topping treatments. All these led to significantly highest seed cotton yield (SCY) and monetary returns under MC 75 g a.i./ha as compared to de-topping treatment. In experiment (2) of high density planting of cotton, sympods per plant, bolls per plant, SCY as well as nitrogen use efficiency (NUE) and monetary returns were increased significantly with 25% increase in recommended dose

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of nitrogen. Among the growth retardants, application of MC 20 g a.i./ha once and twice reduced plant height, increased sympods and boll per plant significantly which led to significantly higher SCY production as compared to control. Similarly, NUE and monetary returns were also significantly higher under MC treatments as compared to control. Application of MC 75 g a.i./ha in either two or three splits on *Bt* cotton hybrid under normal plant density and MC 20–40 g a.i./ha on non *Bt* compact genotype under high plant density optimized source-sink relationship which improve crop productivity and profitability.

Specifications table

Subject	Agricultural Sciences
Specific subject area	Agronomy, crop management, growth regulators
Type of data	Table
How data were acquired	Cotton growth and yield attributes recorded at harvest from field experiments and monetary parameters were calculated by using prevailing wages/prices for different inputs/outputs of cotton crop.
Data format	Raw and Statistically analyzed data
Parameters for data collection	All the treatments were randomized and replicated in both the field experiments. Crop growth and yield parameters i.e. plant height, number of monopods/plant, number of sympods/plant, number of bolls/plant, boll weight (g) and SCY as well as cost of input/output items were considered for data collection.
Description of data collection	Ten representative plants were selected in each plot for recording the data of growth and yield attributes. SCY of whole plot was recorded from all the pickings done from the treatment plots and converted to kg/ha. Monetary parameters were calculated on the basis of prevailing market wages/price of different inputs/outputs.
Data source location	Institution: Punjab Agricultural University, Regional Research Station City: Bathinda (south western cotton belt of Punjab), State Punjab Country: India 151,001 (30°58′N latitude, 74°18′E longitude, altitude 211 m above mean sea level)
Data accessibility	Analysed data is included in this article and raw data is provided as a supplementary data with this article

Value of the Data

- The investigated data highlight the source-sink manipulation through growth retardant i.e. mepiquat chloride (MC) which makes a balance between vegetative and reproductive growth by lesser flower and fruit drop and; more fruit setting led to higher productivity.
- This dataset could be useful for researches for future research on HDPS in cotton for picking mechanization. Farmer's also seek information on cotton response to growth retardants and their field utility.
- This dataset could provide insight for plant physiology research, because MC increases photosynthetic rate by increasing leaf chlorophyll content [1] and increases the N uptake leading into higher SCY [2].
- This dataset could also be used for model evolution for different planting densities and genotypes to optimized crop vegetative growth for higher productivity.

Table 1
Monthly weather data of experimental site during cropping season (2105 and 2017).

Month	Temperature (°C)				Relative Humidity (%)				Total rainfall (mm)		Total Evaporation (mm)	
	Mini.		Maxi.		Mini.		Maxi.					
	2015	2017	2015	2017	2015	2017	2015	2017	2015	2017	2015	2017
April	18.7	18.8	34.3	37.4	34.4	38.7	82.4	65.7	7.2	20.6	265.8	374.4
May	22.5	24.2	41.2	40.3	21.5	31.7	70.1	62.6	29.0	1.8	447.0	450.2
June	25.6	25.3	39.0	36.9	34.4	49.7	75.9	72.8	17.1	177.3	399.8	298.6
July	26.1	27.0	34.8	35.8	58.4	59.6	86.1	81.7	153.0	45.5	228.4	283.5
August	26.5	26.0	34.6	34.8	62.4	62.5	90.5	84.4	110.8	113.6	184.6	211.4
September	23.0	24.1	34.4	34.5	47.2	61.9	87.5	84.9	76.7	0.0	211.2	204.8
October	18.6	17.3	33.2	34.2	39.6	53.1	90.4	90.1	13.0	0.0	167.0	174.2
November	11.5	10.4	27.5	25.1	37.3	54.5	91.5	89.6	0.0	14.0	92.4	58.6
Mean/Total	21.6	21.6	34.9	34.9	41.9	51.5	84.3	79.0	406.8	372.8	1996.2	2055.7

Table 2
Growth, yield and yield contributing characters of *Bt* cotton under different growth retardant treatments (2015).

Treatments	Plant height (cm)	Monopods / plant	Sympods / plant	Bolls/ plant	Boll weight (g)	Seed Cotton Yield (kg/ha)	Plant Stand / ha
Control	110.2	1.39	14.7	27.6	2.77	1147	18,644
MC 50 g a.i./ha at 80 DAS	99.0	1.35	15.8	29.7	2.86	1298	18,838
MC 62.5 g a.i./ha at 80 DAS	98.5	1.35	16.1	30.1	2.96	1383	19,045
MC 75 g a.i./ha at 80 DAS	93.5	1.43	17.0	32.3	3.01	1499	18,690
Three time MC 25 g a.i./ha each at 60,75 and 90 DAS	86.3	1.24	21.6	35.7	3.30	1581	18,193
Twice MC 37.5 g a.i./ha each at 75 and 90 DAS	91.8	1.28	17.4	34.5	3.21	1532	18,937
Three time MC 25, 31.3 and 31.3 g a.i./ha at 60,75 and 90 DAS	87.0	1.45	18.6	36.5	3.39	1625	18,410
De-topping at 80 days	96.5	1.40	15.2	30.6	2.79	1309	19,011
LSD ($p = 0.05$)	11.3	NS	3.40	4.47	0.38	233	NS
CV (%)	8.04	8.23	13.57	9.47	8.59	11.14	2.15

1. Data description

1.1. Weather data

Weather data was recorded at Agrometeorological Observatory, Punjab Agricultural University, Regional Research Station, Bathinda for both the years and presented in Table 1. The experimental site has semi-arid climate with very hot and dry summers from April to June, hot and humid conditions from July to September, cold winters from November to January and mild climate during February and March. Minimum and maximum mean air temperature did not differ much among the years of study. Mean minimum relative humidity was higher during 2017 while, mean maximum relative humidity was higher during 2015. Total rainfall of cropping season was higher during 2015 with lower total evaporation as compared to that of year 2017.

1.2. Experiment 1

Dataset for this experiment shows effect of foliar application of MC on various growth and yield related parameters of *Bt* cotton hybrid (Table 2). All tested treatments of MC, irrespective of dose and time of application reduced plant height significantly as compared to control treatment. Plant height under de-topping treatments was also statistically at par with all MC treat-

Table 3
Nitrogen use efficiency and Monetary analysis of *Bt* cotton under different growth retardant treatments (2015).

Treatments	Nitrogen use efficiency	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
Control	7.7	39,379	49,300	9921	0.25
MC 50 g a.i./ha at 80 DAS	8.7	41,713	55,814	14,101	0.34
MC 62.5 g a.i./ha at 80 DAS	9.3	42,498	59,469	16,971	0.40
MC 75 g a.i./ha at 80 DAS	10.0	43,471	64,468	20,997	0.48
Three time MC 25 g a.i./ha each at 60,75 and 90 DAS	10.6	44,613	67,994	23,381	0.52
Twice MC 37.5 g a.i./ha each at 75 and 90 DAS	10.2	43,989	65,855	21,866	0.50
Three time MC 25, 31.3 and 31.3 g a.i./ha at 60,75 and 90 DAS	10.9	45,152	69,886	24,734	0.55
De-topping at 80 days	8.8	44,006	56,298	12,292	0.28
LSD ($p = 0.05$)	1.56	1396	10,006	8610	0.18
CV (%)	11.13	2.20	11.14	32.4	30.4

ments. Reduction in gibberllic acid and auxins content in plants with application of MC and de-topping were the reason for reduction in plant height [3,4]. Number of monopods/plant were not affected but higher number of sympods per plant were produced under three time application of MC 25 g a.i./ha each at 60,75 and 90 DAS as compared to single application of MC, de-topping and control. Yield contributing parameters, number of bolls/plant and boll weight were significantly highest under the treatments of three time application of MC as compared to control, de-topping and single application of MC (Table 2). All these treatments of MC favoured source-sink relationships by reducing plant height and improving yield attributes, produced significantly higher SCY under three time application of MC as compared to control and de-topping. Better canopy architecture with dwarf plants, short sympodia and bigger bolls obtained by chemical regulation through MC [5,6]. SCY under three time application of MC 25 g a.i./ha each at 60, 75 and 90 DAS was higher by 37.8 and 20.7 per cent as compared to control and de-topping treatments, respectively. Plant stand per unit area presented in Table 2, was not affected by the treatments.

Data in Table 3 shows that because of higher SCY, NUE was also significantly higher under all MC treatments as compared to control and de-topping except single application of MC 25 g a.i./ha. In case of monetary parameters, cost of cultivation was significantly higher under two and three time application of MC and de-topping as compared to all other treatments. Gross returns, net returns and benefit cost ratio were varied with SCY and these were also higher under three time application of MC as compared to control and de-topping treatments.

1.3. Experiment 2

Data in Table 4 presents response of cotton growth and yield attributes to nitrogen levels and growth retardant under HDPS. Plant height, numbers of sympods/plant increased significantly with increase in nitrogen level, while numbers of monopods/plant did not affected significantly. Among yield attributes, number of bolls/m^2 increased significantly with increase in nitrogen levels, while boll weight was non-significant. Data shows that significant improvement in SCY with increase in nitrogen level from 100 to 125% of recommended dose of nitrogen (RDN). However, further increase in nitrogen level from 125% to 150% RDN having non-significant negative impact on SCY. In case of growth retardants, MC also had significant affect on various parameters of cotton (Table 4). Both single and twice application of MC 20 g a.i./ha were effective in reducing the plant height than control. Number of sympods and bolls per plant were increased significantly under both treatments of MC as compared to control. MC treatments produced significantly higher SCY as compared to control. Single and twice applications of MC (20 g a.i./ha)

Table 4
Growth, yield and yield contributing characters of high density planted cotton under different fertilizer and growth retardant treatments (2017).

Treatments	Plant height (cm)	Monopods / plant	Sympods / plant	Bolls/m^2	Boll weight (g)	Seed Cotton Yield (kg/ha)
Nitrogen						
100% RDN	112	0.62	15.6	184	2.97	2118
125% RDN	120	0.71	18.6	210	3.04	2421
150% RDN	126	0.62	18.5	207	3.06	2278
LSD ($p = 0.05$)	10	NS	1.1	16	NS	235
Growth retardant						
Control	130	0.62	14.7	170	2.95	2080
MC 20 g a.i./ha at 60 DAS	120	0.62	18.5	213	3.08	2344
MC 20 g a.i./ha at 60 and 75 DAS	108	0.71	19.6	218	3.04	2393
LSD ($p = 0.05$)	10	NS	1.1	16	NS	235
CV (%)	8.81	11.29	6.32	8.05	5.53	10.36

Table 5
Nitrogen use efficiency and Monetary analysis of high density planted cotton under different fertilizer and growth retardant treatments (2017).

Treatments	Nitrogen use efficiency	Cost of cultivation (Rs./ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
Nitrogen					
100% RDN	14.2	47,955	95,290	47,334	0.98
125% RDN	13.0	50,162	108,964	58,802	1.17
150% RDN	10.2	49,463	102,522	53,058	1.07
LSD ($p = 0.05$)	1.3	1529	10,583	8333	0.14
Growth retardant					
Control	11.4	47,178	93,601	46,423	0.98
MC 20 g a.i./ha at 60 DAS	12.8	49,659	105,484	55,825	1.12
MC 20 g a.i./ha at 60 and 75 DAS	13.1	50,743	107,690	56,947	1.12
LSD ($p = 0.05$)	1.3	1529	10,583	8333	NS
CV (%)	10.70	3.11	10.36	15.72	12.80

produce higher SCY by margin of 12.7 and 15.0 per cent as compared to control. MC regulates canopy architecture with dwarf plants, bigger bolls and higher SCY [5,6].

Data in Table 5 indicated that NUE had inverse relation with rate of nitrogen application; NUE was significantly higher under lowest nitrogen level of 100% RDN and vice-versa. This was because of the failure of proportional increase in SCY with each increase in nitrogen levels [7]. Cost of cultivation, net returns and benefit cost ratio were significantly higher under 125% and 150% RDN as compared to 100% RDN. Cost of cultivation varies due to the cost of nitrogenous fertilizer and picking. Further data presented in Table 5 shows that, foliar application of MC, irrespective of dose and frequency of application led to a significant increase in NUE over control treatment. Cost of cultivation, gross returns, net returns and benefit cost ratio were also recorded higher under treatments of single and twice application of MC as compared to control.

2. Experimental design, materials, and methods

Two different field experiments were conducted during *kharif* 2015 and 2017, respectively at Punjab Agricultural University, Regional Research Station, Bathinda which lies in Trans Gangetic agro climatic zone, which representing the Indo Gangetic alluvial plains of Punjab (30°58′ N latitude, 74°18′ E longitude, altitude 211 m above mean sea level).

The first field experiment was conducted during *Kharif* 2015 to optimize source-sink relationship in *Bt* cotton hybrid. The soil of the experimental field was loamy sand in texture, slightly alkaline (pH 8.1), electrical conductivity 0.140 m mhos/cm, low in available organic carbon (0.37%), medium in available phosphorus (25.7 kg P_2O_5/ha) and high in available potassium (262.5 kg K_2O/ha). *Bt* hybrid NCS-855 BG-II was sown at cropping geometry of 67.5 × 75 cm (normal plant density for *Bt* hybrids). The Experiment was comprised of eight treatments i.e. T_1= Control, T_2= MC 50 g a.i./ha at 80 DAS, T_3= MC 62.5 g a.i./ha at 80 DAS, T_4= MC 75 g a.i./ha at 80 DAS, T_5= Three time MC 25 g a.i./ha each at 60, 75 and 90 DAS, T_6= Twice MC 37.5 g a.i./ha each at 75 and 90 DAS, T_7= Three time MC 25, 31.3 and 31.3 g a.i./ha at 60, 75 and 90 DAS, respectively and T_8= De-topping at 80 days, replicated four times in randomized complete block design.

The second field experiment was conducted during *Kharif* 2017 to maintain a balance between vegetative and reproductive growth of cotton under HDPS. The soil of the experimental field was loamy sand in texture, slightly alkaline (pH 8.3), electrical conductivity 0.210 mmhos/cm, low in available organic carbon (0.28%), medium in available phosphorus (18.5 kg P_2O_5/ha) and high in available potassium (240 kg K_2O /ha). The Non-*Bt* compact genotype F2383 recommended for HDPS was grown at spacing of 67.5 × 15 cm. The experiment was consisting three nitrogen levels i.e. 100% RDN, 125% RDN and 150% RDN and three levels of plant growth retardant i.e. Control, MC 20 g a.i./ha at 60 DAS and Twice MC 20 g a.i./ha each at 60 and 75 DAS, in factorial RBD design with three replications.

Ten representative plants were selected in each plot for recording the data of growth and yield attributes. SCY was recorded from all the pickings done from the treatment plots and converted to kg/ha. The data was analysed as per standard procedure given by Gomez and Gomez [8] with ANOVA to evaluate the differences between treatments means were compared using LSD test ($p = 0.05$).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.dib.2020.105914.

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